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ABSTRACT

School children frequently fail to adequately understand terms associated with musical pitch although research shows that even infants with normal hearing can perceptually discriminate fine pitch variations. This study investigated children's perceptions of dimensions of sound by focusing on their choice of musical sounds and relevant verbalization. Subjects were 13 children approximately 5 years of age who attended kindergarten or preschool and were identified by their teachers as having superior verbal skills. Ability to discriminate sounds and to label dimensions that were different were explored by presenting selected melodic percussive instruments, including tubular bells, a xylophone, jingle bell shakers, and beaters. Cognitive ability was assessed with the Enticknap Picture Vocabulary Test and subjects' scores were converted into a "picture age" (PA) and a "picture quotient" (PQ). Correlation coefficients between PA's and PQ's and the raw scores of children verbalizing correctly about perceived differences between paired sounds were not statistically significant. When five children instructed to produce sounds differing in intensity or pitch were retested, their scores on some of the tasks improved significantly. Implications are discussed. (RH)

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ABSTRACT

Eleven pre-school age children were identified by their kindergarten/pre-school teachers as having a high level of verbal competence. Given a small collection of musical equipment with which to experiment the children were asked to verbalize their perceptions of the differences between pairs of "different" sounds they were asked to make. These raw scores were compared with the subjects' "picture ages" and "picture quotients" as measured by a picture vocabulary test.

The correlation coefficients between each of the Picture Ages and Picture Quotients and the raw scores of children verbalising correctly about perceived differences between the paired sounds were not statistically significant.

Five children were given a short series of relevant "learning experiences" and then re-tested. A significant improvement was recorded. Implications of the difficulties experienced by subjects and the marked improvement in verbalisation about perceived differences after brief learning experiences in classification skills are discussed.

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One of the major difficulties for educators and researchers working with young children is the difficulty of ensuring that both adults and children have the same understanding of words used.

Some factors contributing to this dilemma may be:

- the greater experience of adults, providing them with a wider range of options from which to select when making decisions;
- the different learning modes of young children, tending to respond in terms of immediate perception rather than reflective discrimination;
- the supposed egocentricity of children, their current interests and experiences influencing both their motivation to learn and their developing concept formation;
- conversely, the failure of many adults to decentre their own thinking in order to accomodate the action-oriented or more literal meanings of young children;
- inconsistency in the use of terminology.

This is particularly so in the area of musical concepts, the research available producing apparently contradictory results (McMahon, 1982). Crowther and Durkin (1982) report studies indicating that "the terms associated with musical pitch..... are frequently ill-understood by children well into primary school or even at secondary level". They suggest that it appears unlikely that this is a "perceptual or auditory problem", citing a number of research studies indicating that normal" hearers can perceptually discriminate fine pitch variations from early infancy".

A New Zealand study by Sharman (1977) supported the hypothesis that children "understand musical concepts but lack the appropriate vocabulary".

A theoretical model of music perception and talent outlined by Heller & Campbell (1981) was extended by Crowther & Durkin (1982) in their paper "Towards an Applied Psycholinguistic Study of Musical Concept Development". A "Word Meanings Questionnaire" containing pairs of statements relating to the spatial usage and musical usage of target musical terms was completed by Social Science undergraduate students. Analysis of the results indicated that "some association between the spatial usage of a term and its musical sense appears appropriate and of value in the teaching of basic musical terminology".

Another possible factor confounding children's understanding of basic musical terms such as high/low and soft/loud is that these are subjective perceptions of dimensions of sound - which may be measured objectively in terms of frequency and intensity.

Many young children tend to classify pitch differences in terms of loudness. Examination of an "equal loudness contour" demonstrates visually that the "tones in the middle range of frequencies sound

considerably louder than equally intense tones outside this range" (Coren et. al., 1979). They suggest that "the subjective qualities of loudness and pitch are complex perceptions that depend upon the interaction of several physical characteristics of the stimulus, as well as the physical and psychological state of the observer".

One implication of Buckton's (1983) analysis of performance in various types of pitch mastery tasks is relevant. Classification of types of tasks into five domains showed few between-group differences in two of the domains. Further examination revealed that these two domains did not "require the use of pitch concept language". The children were required only to play or copy sounds or identify pictures of particular sounds.

Earlier studies exploring children's abilities to discriminate the dimensions of sound have tended to present pairs or groups of recorded sounds, to require same/different judgements and/or to ask questions using generally accepted adult terminology (Thackray, 1974; McMahon, 1982).

One way of avoiding misconceptions of terms used is to allow the children to do their own organising - to make their own sounds and to provide their own terminology, restricted though this may be, in describing differences between those sounds. This view is supported by Gelman (1978). After reviewing recent literature on cognitive development he suggests that the "quality of a young child's performance on classification tasks" is affected by the characteristics of the stimuli, the way the study is designed and the strategies brought to the task by the children.

In 1982 McMahon reported a study underlining the "importance of the role of language in concept formation". Trabasso (cited in Gelman, 1978) claims "linguistic difficulties as a major source of difficulties confronting the

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young child".

Clark (1979) identifies a "heightened sensory awareness" as a characteristic of high achieving children. She suggests that they "usually exhibit the ability to generalise, to work comfortably with abstract ideas, and to synthesize diverse relationships to a far higher degree". Differentiating characteristics are a "high level of language development" and a "high level of verbal ability".

The present study aimed to investigate children's perceptions of dimensions of sound by focusing on their choice of musical sounds and relevant verbalisation.

Procedure

In order to control for some difficulties outlined above, teachers in three kindergartens/pre-schools were asked to identify five year old children exhibiting a high level of verbal competency.

The Enticknap Picture Vocabulary Test was used to provide a "quick estimate of the cognitive abilities" of the children, the raw scores being converted into a picture age (PA) in years and months and into a quotient (PQ) by expressing the PA as a percentage of the chronological age.

The children's ability to discriminate sounds and to label dimensions that were different was explored by the presentation of selected melodic percussive instruments, jingle bells, shakers and contrasting beaters.

Method

Phase 1

The subjects were 13 pre-school age children (6 girls and 7 boys) attending kindergartens or preschools. Their age range extended from 5 years to 5 years 10 months. Subjects were invited to identify the black and white pictures of the Enticknap Picture Vocabulary Test and then to play with a selection of musical instruments placed within easy reach. Each subject was given sufficient time to explore all the instruments, the experimenter drawing attention to an occasional one which was overlooked.

The instruments were:

3 tubular bells of differing pitch,
3 xylophone keys of differing pitch,
3 jingle bell shakers of differing pitch,

2 contrasting pairs of shakers,
4 beaters (3 rubber and 1 wooden).

In each of Tasks 1, 2 and 3 subjects were requested to make two different sounds, and then to explain how or why they were different.

In Tasks 4, 5 and 6 the subjects were similarly asked to make and classify two different sounds, but were requested to use all the limited equipment provided for each task as follows:

Task 4 - 2 tubular bells, 2 xylophone keys and 2 contrasting beaters.
Task 5 - 1 xylophone key and 1 wooden beater,
Task 6 - 1 tubular bell, 1 xylophone key and 2 contrasting beaters.

Phase 2

The first five subjects tested were used as an experimental group and involved as a group in vocal, instrumental and mime experiences aimed to increase their repertoire of classification skills relating to the pitch, dynamics and rate of production of sounds.

Instruments different to those used in the tests were provided. A 13 note glockenspiel, a pentatonic xylophone, 4 hard rubber beaters and 2 soft ones were substituted.

Four 10/15 minute sessions took place over a period of 14 days. The children attended kindergarten three days per week.

Phase 3

The five children in the experimental group were then retested with Tasks 1, 2 3 and 5, and 4 new ones in which subjects were asked to play:

a loud sound, then a soft one (Task 7);
a high sound, then a low one (Task 8);
and to sing:
a soft sound, then a loud one (Task 9);
a low sound, then a high one (Task 10).

Analysis of Results

Phase 1

Only Tasks 1, 2 and 3 produced any positive results. Six subjects correctly discriminated 10 pairs of sounds, 9 in terms of pitch and only one in terms of intensity. Four others discriminated pitch in terms of intensity, and the remaining 3 recorded no correct discriminations.

The subjects' Picture Ages (PAs) ranged from six years one month to seven years three months, and their Picture Quotients (PQs) from 112.3 to 136.1.

The correlation coefficients between PAs and Correct Discriminations of pitch/loudness differences (CDs), and between PQs and CDs, for the 6 subjects discriminating correctly any differing dimensions, were not statistically significant.

A comparison of PAs and CDs indicated a PA lower limit of 6 years 5 months for subjects recording any CDs.

Phase 3

The experimental group's raw scores on Tasks 1, 2 and 3 improved considerably. There was still some confusion with pitch differences being reported in terms of intensity, but the "quality" of response was remarkable. Several of the children were able to correctly discriminate the pitch of a short xylophone key and a longer (but higher pitched) glockenspiel one.

Only one subject (the youngest) had any difficulty with the "sung" responses. Task 5 still proved difficult for the subjects to conceptualize.

INSERT TABLE 1 ABOUT HERE

None of the correlation co-efficients between Test 2 raw scores and chronological ages, PAs and PQs reached a statistically significant level.

Discussion and Implications

The readiness of subjects to provide pairs of sounds differing in some way in an open format indicated clearly that that was a concept with which they had no difficulty. The difficulty lay in their inability to express their

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discrimination of differences in language which would provide meaningful clues to their thought processes.

Consideration of the data in Table 1 suggests that even a brief period of practice in discrimination will improve children's skills, but comparison of chronological ages and raw scores supports theories proposing developmental stages and sub-stages.

Halford (1982) suggests that "there are clear limits to the concepts which children at a particular age can master" and that "there are limits to the amount of information which can be synthesized in a single decision or a single representation". He hypothesizes that "the concepts which children can understand, and the thinking they can perform, are limited by working memory".

Gelman & Gallistel (1978) support the view that training induces "the use of a pre-existing ability to categorize" rather than "instill" the ability.

Some of the factors determining an upper limit to performance appear to include chronological age, developmental stage, learning strategies, effective instruction and language competence.

In 1977 Flavell drew attention to our knowledge of pre-school aged children's cognitive inadequacies, highlighting the need to learn more of their capacities. This preliminary study has explored some of the factors which may be relevant, particularly the relationship between perceptual learning, language and cognitive development.

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TABLE 1

RESPONSES TO BOTH TESTS, CHRONOLOGICAL AGES, PAs AND POs

Subject	Test 1 [Tasks 1,2,3 / 3]	[Tasks 1,2,3 / 8 = 3] + [Tasks 7,8,9,10 / 4] + [Task 5 / 1]					Age	PA	PQ
1	1	2 = 0	+	1	+	1	5.1	6.11	136.1
2	2	6 = 3	+	3	+	0	5.2	6.5	124.2
3	0	4 = 0	+	4	+	0	5.3	6.3	119
4	1	7 = 3	+	4	+	0	5.4	6.5	120.3
5	0	6 = 1	+	4	+	1	5.5	6.1	112.3